

EUROPEAN PATENT APPLICATION

(51) Int Cl.⁶: **G01L 19/00**

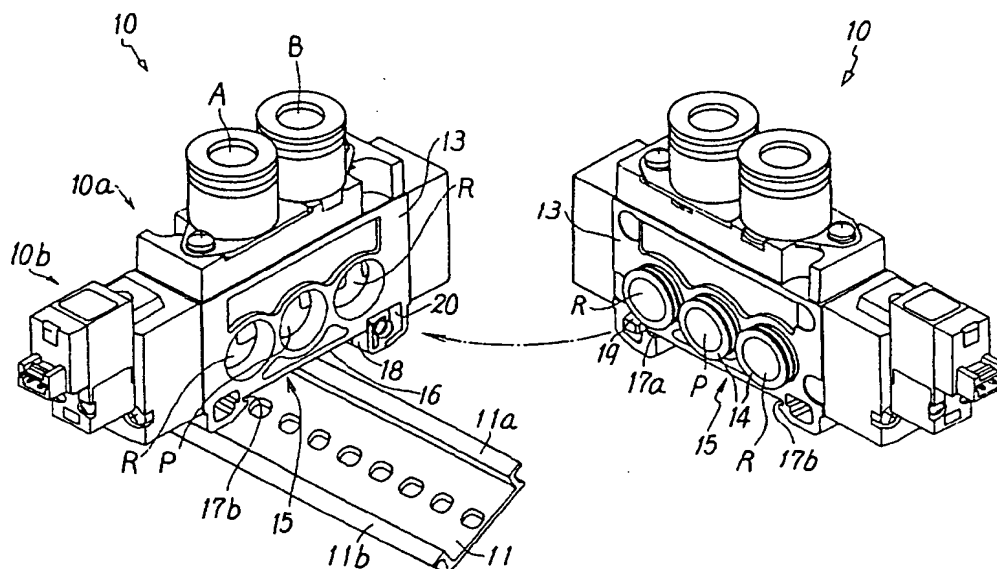
(22) Date of filing: 05.01.1999

(74) Representative: Findlay, Alice Rosemary
Lloyd Wise, Tregear & Co.,
Commonwealth House,
1-19 New Oxford Street
London WC1A 1LW (GB)

(71) Applicant: SMC CORPORATION
Minato-ku Tokyo 105 (JP)

piece 18, which defines the depth of one of the recessed portions 17a is provided to the side of the recessed portion 17a in such a way as to be elastically movable. A stopper 19 is also provided to the side of the first recessed portion 17a which engages the elastic piece 18 of an adjacent fluid-pressure indicating apparatus so as to control its movement when the apparatus is coupled to the adjacent fluid-pressure indicating apparatus.

FIG. 1



Description

[0001] The present invention relates to a fluid-pressure indicating apparatus that is mounted on a rail, and in particular, to a fluid-pressure indicating apparatus including a mounting mechanism with a lock function for preventing the apparatus from slipping out from the rail when it does not need to be removed therefrom.

[0002] There are a number of well known techniques for mounting a plurality of control valves on a rail either directly or via manifolds, in order to control these valves collectively.

[0003] For example, Japanese Patent Publication No. 8-2536 discloses a conventional mounting mechanism used to mount fluid-pressure indicating apparatuses, such as directional control valves or manifolds, onto a rail. As shown in Fig. 7, in this mounting mechanism, a mounting groove 4 is provided at the bottom surface of the body 2 of a directional control valve 1. A rail 3 is fitted in the mounting groove 4. On one side of the mounting groove 4, a recessed portion 5 is formed in which one flange 3a of the rail 3 is fitted and locked. An elastic locking piece 6 including a jaw portion 6a with which the other flange 3b is engaged is provided on the other side wall.

[0004] The directional control valve 1 is mounted on the rail 3 by fitting the flange 3a of the rail 3 in the recessed portion 5, and then pressing the rail 3 into the mounting groove 4 while allowing the other flange 3b to elastically deform the elastic locking piece 6, thereby engaging the flange 3b with the jaw portion 6a of the elastic locking piece 6. Conversely, the directional control valve 1 is removed from the rail 3 by elastically deforming the elastic locking piece 6 to remove the flange 3b from the jaw portion 6a, and then pulling the other flange 3a out from the recessed portion 5.

[0005] Such a mounting mechanism has the advantage that the directional control valve 1 may be mounted on the rail 3 at any desired position and removed therefrom. The mechanism even allows a directional control valve located in the middle of a plurality of such valves to be simply detached therefrom.

[0006] This mechanism has no problems under normal operating conditions, but if an unexpected force is applied to the directional control valve, for example via a pipe connected to the valve, in such a way that the valve is pulled in a direction away from the rail, the valve may slip out from the rail. Thus, the directional control valve must be prevented from slipping out accidentally.

[0007] It is a technical object of this invention to provide a fluid-pressure indicating apparatus including a mounting mechanism with a lock mechanism which can be simply removed from a rail when used alone but which cannot be removed from the rail when coupled to adjacent apparatuses.

[0008] A fluid pressure indicating apparatus according to this invention comprises first and second recessed portions formed in the opposed groove walls of

a rail mounting groove in which locking flanges on the respective sides of a rail are fitted and engaged. An elastic piece that defines the depth of the first recessed portion is provided on the side of the first recessed portion in such a way as to be elastically movable. A stopper is also provided on the side of the first recessed portion that engages the elastic piece of an adjacent fluid-pressure indicating apparatus to control its movement when the apparatus is coupled to this adjacent fluid-pressure indicating apparatus.

[0009] The fluid-pressure indicating apparatus of this configuration is mounted on the rail by fitting one of the flanges of the rail in the first recessed portion of the mounting groove, allowing the flange to press the elastic piece so that the rail can move toward the first recessed portion, fitting the rail in the mounting groove, and then moving it in the horizontal direction toward the second recessed portion so that the other flange is engaged in the second recessed portion. The fluid-pressure indicating apparatus can be removed from the rail by performing the same operations in reverse order.

[0010] When a number of such fluid-pressure indicating apparatuses are mounted on the rail and adjacent apparatuses are coupled together, the stopper of one fluid-pressure indicating apparatus engages and locks with the elastic piece of the adjacent apparatus to control its movement. In this way, the lock acts on the adjacent fluid-pressure indicating apparatus to prevent it from being removed from the rail. This prevents the fluid-pressure indicating apparatus from slipping out from the rail even if a large external force is applied to the apparatus via a pipe.

[0011] According to a preferred embodiment, the elastic piece is mounted in a hollow formed on one side face of the fluid-pressure indicating apparatus, and the stopper is provided on the other side face in such a way as to protrude outwardly.

[0012] According to the preferred embodiment, the elastic piece extends from a mounting portion so as to be elastically deformed, and a space into which the stopper of an adjacent apparatus is inserted is formed behind the elastic piece.

[0013] In one embodiment, the mounting groove, recessed portions, and stopper are directly formed in the body of the fluid-pressure indicating apparatus.

[0014] In another embodiment, a rail fixture that is separate from the body of the fluid-pressure indicating apparatus is mounted on the body, and the mounting groove, recessed portions, and stopper are provided in the fixture. In this case, at least one of the elastic piece and stopper can be integrated with the rail fixture.

[0015] The invention will now be described by way of example with reference to the accompanying drawings in which:

[0016] FIG. 1 is a perspective view showing a first embodiment of a fluid-pressure indicating apparatus according to this invention.

[0017] FIG. 2 is a perspective view showing several

members disassembled from the fluid-pressure indicating apparatus in FIG. 1.

[0018] FIG. 3A is an enlarged view of the part of the fluid-pressure indicating apparatus and FIG. 3B is an enlarged front view of an elastic piece.

[0019] FIG. 4 is a side view of the fluid-pressure indicating apparatus before it is completely mounted on a rail.

[0020] FIG. 5 is a side view of the fluid-pressure indicating apparatus after it is mounted on the rail.

[0021] FIG. 6 is a perspective view showing a second embodiment of a fluid-pressure indicating apparatus according to this invention.

[0022] FIG. 7 is a side view showing how a conventional fluid-pressure indicating apparatus is mounted.

[0023] FIGS. 1 to 5 show a first embodiment of a directional control valve 10 (in other words, a kind of fluid-pressure indicating apparatus). A number of such directional control valves 10 are mounted together on a rail 11.

[0024] The rail 11 has a groove-shaped cross section, and has locking flanges 11a and 11b formed at the respective upper ends of its opposite groove walls and extending outward.

[0025] The directional control valve 10 is a solenoid pilot-operated directional control valve comprising a main valve section 10a for switching the direction of the flow of a working fluid such as compressed air and a solenoid-operated pilot valve section 10a for driving the main valve section 10a.

[0026] The body 13 of the main valve section 10a is rectangular and has one supply through-hole P and two ejection through-holes R, R so that the working fluid is supplied and ejected from the valve mechanism through these through-holes and so that the fluid is then output through two output ports A and B formed in the top surface of the body 13. When a number of directional control valves 10 are mounted on the rail 11 and coupled together, the through-holes P and R, R in the directional control valve 10 communicate with the through-holes P and R, R in the adjacent directional control valve 10 via a short pipe 14, and the working fluid is concurrently supplied to and ejected from the directional control valves 10 through a supply and ejection block (not shown), which includes a supply port and an ejection port.

[0027] A mounting mechanism 15 for mounting the directional control valve on the rail 11 is formed on the bottom surface of the body 13. The mounting mechanism 15 has a mounting groove 16 in which the rail 11 is fitted, and a first and a second recessed portions 17a, 17b in which the flanges 11a, 11b of the rail 11 are fitted and locked are formed in the laterally opposed groove walls of the mounting groove 16. An elastic piece 18 that defines the depth of the first recessed portion 17a is provided on the body portion on the side of the first recessed portion 17a so as to be elastically shifted when abutted on by the flange 11a. A stopper 19 is also pro-

vided on the body portion on the side of the first recessed portion so that when the directional control valve is joined with the adjacent directional control valve, it engages the elastic piece 18 of the adjacent valve to regulate its shifting.

[0028] As seen in FIGS. 2, 3A, and 3B, the elastic piece 18 is mounted in a hollow space 20 formed in one (a joint surface) of the sides of the body 13.

[0029] The hollow space 20 is shaped like a rectangle and formed so that its inner end, which extends to the mounting groove 16, overlaps the first recessed portion 17a, and this inner end is open and is in communication with the mounting groove 16.

[0030] The elastic piece 18 has a mounting portion 18a that is fixed in the hollow space 20 using a screw 22 or another appropriate means. The elastic piece 18 extends from one end of the mounting portion 18a so as to be elastically formed, and is located on the side of the inner end of the hollow space 20 across the first recessed portion 17a. A space 23 into which a stopper 19 is inserted is formed behind the elastic piece 18. The elastic piece 18 is formed of an elastic material such as synthetic resin, rubber, or metal.

[0031] The means for fixing the mounting portion 18a in the hollow space 20b includes not only the screw 22 but also adhesion, press-fitting, and locking.

[0032] In addition, the stopper 19 is formed on the side of the body that is opposite to the side on which the elastic portion 18 is provided and at a position corresponding to the insertion space 23. The stopper is formed in such a way as to protrude outward. The stopper 19 may be integrated with the body 13 or may have another part mounted thereon.

[0033] The directional control valve 10 of this configuration is mounted on the rail 11 by fitting the first flange 11a of the rail 11 in the first recessed portion 17a of the mounting groove 16, allowing the first flange 11a to press and shift the elastic piece 18 so that the rail 11 moves toward the first recessed portion 17a, and fitting the rail 11 in the mounting groove 16, as shown in FIG. 4. Then, when the rail 11 is moved horizontally toward the second recessed portion 17b to allow the second flange 11b to be fitted in the second recessed portion 17b, the elastic piece 18 returns to allow the flanges 11a and 11b to keep the rail 11 fitted in the recessed portions 17a and 17b, thereby allowing the directional control valve 10 to be mounted on the rail 10.

[0034] The directional control valve 10 may be removed from the rail 11 by performing the same operations in the reverse order.

[0035] When a plurality of directional control valves are mounted on the rail 11 and adjacent apparatuses are coupled together, the stopper of one directional control valve 10 is fitted in the insertion space 23 and locked behind the elastic piece 18 of the adjacent valve to regulate its shifting, thereby preventing the rail 11 from being moved to the first recessed portion 17a side. Consequently, the directional control valve 10 cannot be re-

moved from the rail 11. This configuration prevents the directional control 10 valve from slipping out from the rail 11 even if a large external force is applied to the valve 10 via the pipe connected to the output port.

[0036] To remove one of the assembled directional control valves 10 from the rail 11, that directional control valve may be disconnected from the adjacent valves and the elastic piece 18 may be released from the stopper 19.

[0037] FIG. 6 shows a second embodiment of a directional control valve 10A in which a mounting mechanism 15 is formed by providing on the bottom surface of the body 13 a rail fixture 25 formed separately from the body 13. In the fixture 25, the mounting groove, two recessed portions 17a and 17b, elastic piece 18, and a stopper 19 are provided.

[0038] The fixture 25 is formed of a material such as synthetic resin or metal having a sufficient strength for such a fixture, and is mounted on the body using an appropriate means such as a screw. The form in which the mounting mechanism 15 is installed on the fixture 25 is substantially the same as the form in which the mounting mechanism is directly installed on the body 13 of the directional control valve 10.

[0039] If the fixture 25 is formed of a synthetic resin, either the elastic piece 18 or the stopper 19 should be integrated with it.

[0040] Although the above embodiments show the directional control valve as an example of a fluid-pressure indicating apparatus, this invention is of course applicable to other fluid-pressure indicating apparatuses such as manifolds.

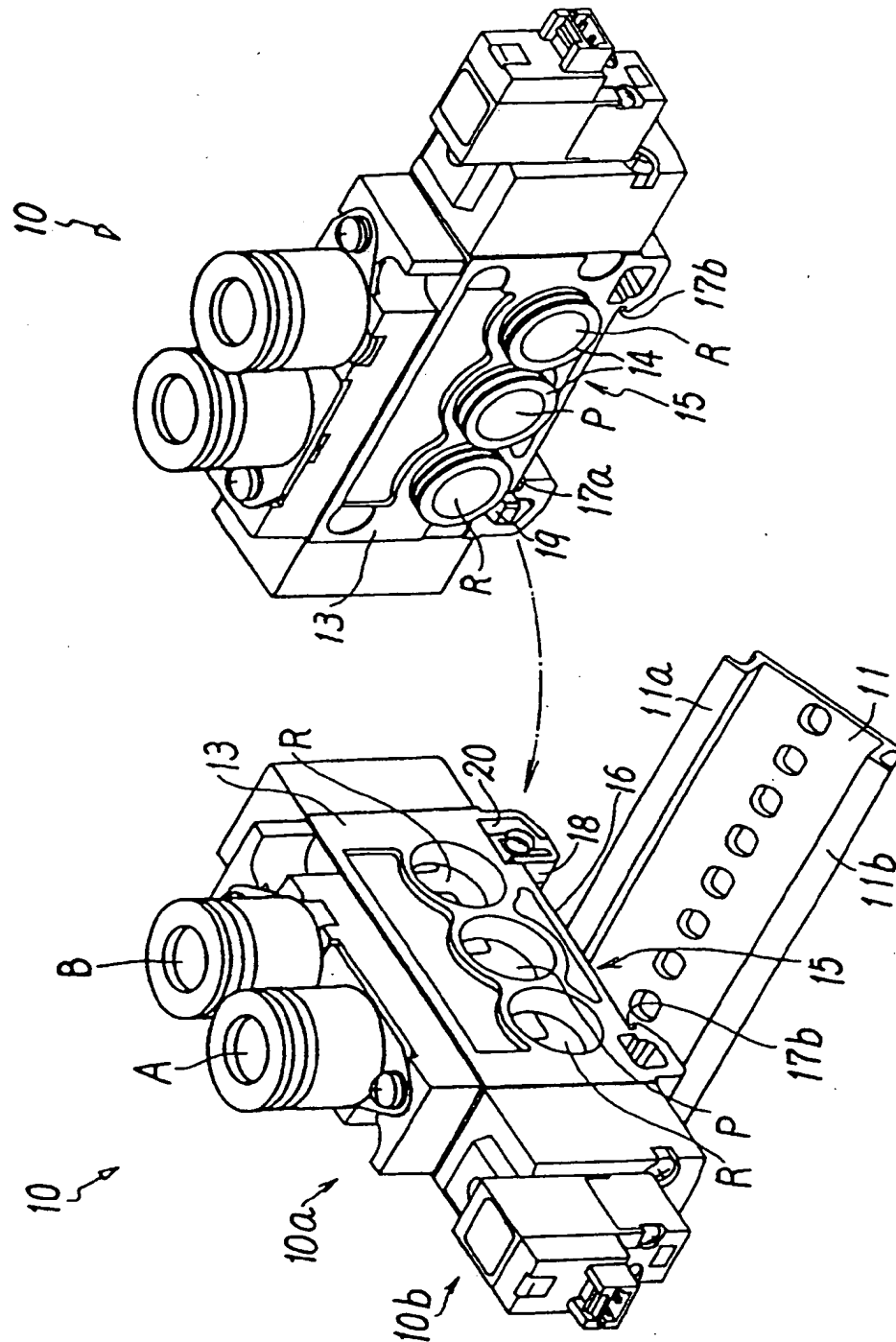
[0041] As described above, according to this invention, when a single fluid-pressure indicating apparatus is removed from the rail for maintenance or the like, the lock function is canceled to allow this apparatus to be removed easily, whereas if adjacent fluid-pressure indicating apparatuses are coupled together, the lock function is automatically activated to prevent the apparatuses from being removed from the rail. This configuration prevents the fluid-pressure indicating apparatus from slipping out from the rail even if a large external force is applied to the apparatus via a pipe. As a result, this apparatus can be used over a wide pressure range, and can be handled safely and easily during pipe-laying work.

Claims

1. A fluid-pressure indicating apparatus that is mountable on a rail which has outwardly extending side locking flanges,
the apparatus comprising a mounting groove in which the rail is fitted, first and second recessed portions in which the locking flanges of a rail are fitted and locked formed on the opposed groove walls of the mounting groove, and a locking mechanism

comprising an elastic piece that defines the depth of the first recessed portion provided on the side of the first recessed portion in such a way as to be elastically moved when abutted by a rail flange, and a stopper provided on the side of the first recessed portion that engages the elastic piece of an adjacent such fluid-pressure indicating apparatus to control its movement when the apparatus is joined with the adjacent fluid-pressure indicating apparatus.

2. A fluid-pressure indicating apparatus as claimed in Claim 1 wherein a hollow is formed in one side face of the fluid-pressure indicating apparatus, the elastic piece being mounted in the hollow, and the stopper is provided on the other side face in such a way as to protrude outwardly therefrom.
3. A fluid-pressure indicating apparatus as claimed in Claim 2 wherein the locking mechanism includes a mounting portion that is located in the hollow, wherein the elastic piece extends from the mounting portion so as to be located across the first recessed portion, and wherein a space for receiving the stopper of an adjacent such apparatus is provided opposite the elastic piece from the first recessed portion.
4. A fluid-pressure indicating apparatus as claimed in any one of Claims 1 to 3 wherein the mounting groove, recessed portions, and stopper are directly formed in the body of the fluid-pressure indicating apparatus and wherein the elastic portion is separately formed and then assembled with these components.
5. A fluid-pressure indicating apparatus as claimed in any one of Claims 1 to 3 wherein the apparatus includes a main body and wherein the mounting groove, recessed portions, elastic piece, and stopper are provided in a separate rail fixture which is mounted on the main body.
6. A fluid-pressure indicating apparatus as claimed in Claim 5 wherein the elastic piece and/or the stopper is integral with the rail fixture.



LEIG.

FIG. 2

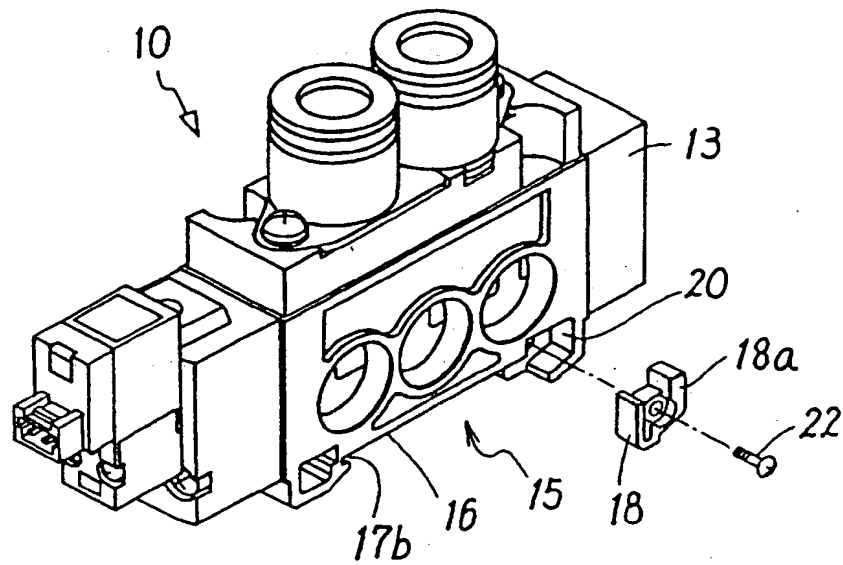


FIG. 3

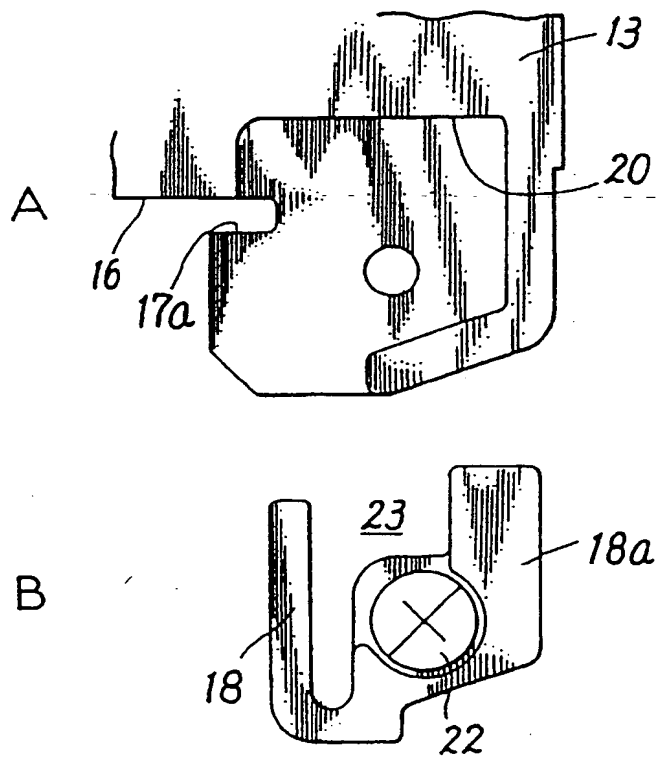


FIG. 4

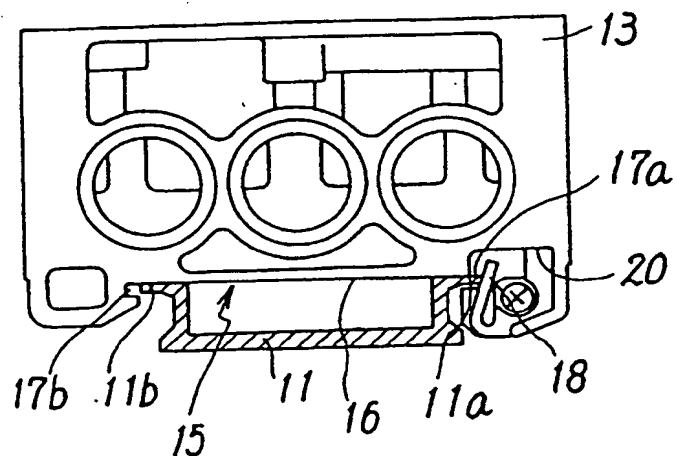


FIG. 5

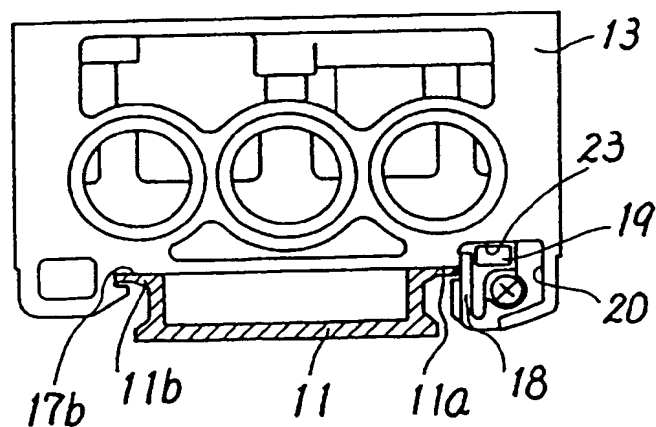


FIG.6

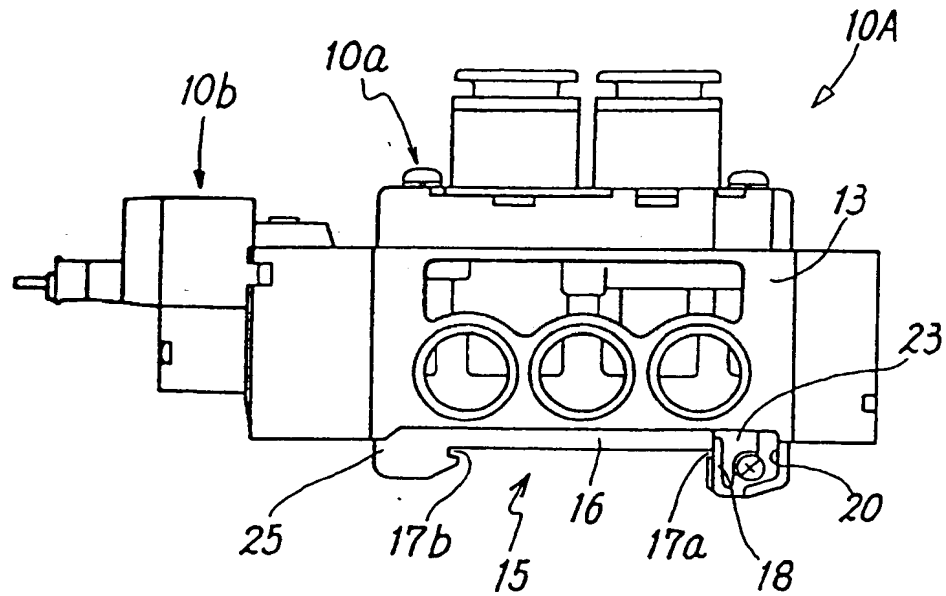
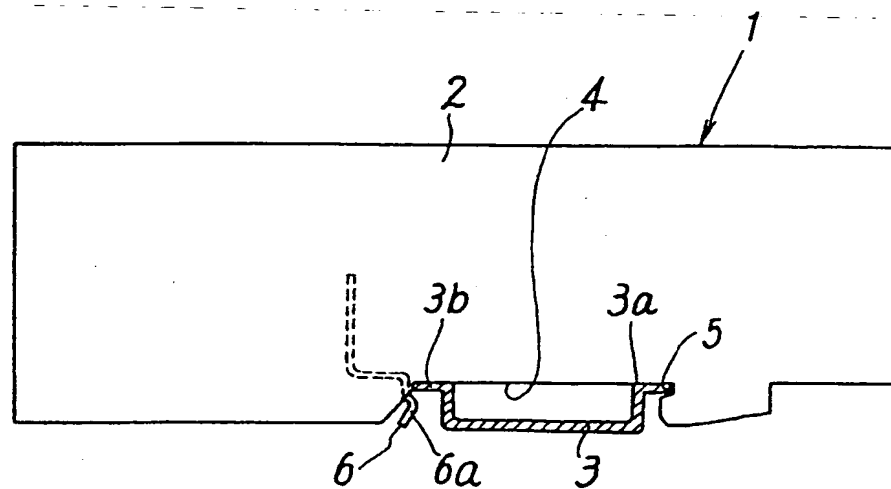
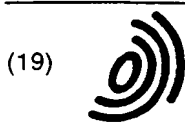


FIG.7





Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) EP 0 928 960 A3

(12) EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
08.12.1999 Bulletin 1999/49

(51) Int Cl.⁶ G01L 19/00

(43) Date of publication A2:
14.07.1999 Bulletin 1999/28

(21) Application number: 99300038.9

(22) Date of filing 05.01.1999

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(72) Inventor: Miyazoe, Shinji
Yawara-mura, Tsukuba-gun, Ibaraki (JP)

(74) Representative: Findlay, Alice Rosemary
Lloyd Wise, Tregear & Co.,
Commonwealth House,
1-19 New Oxford Street
London WC1A 1LW (GB)

(30) Priority 06.01.1998 JP 1212198

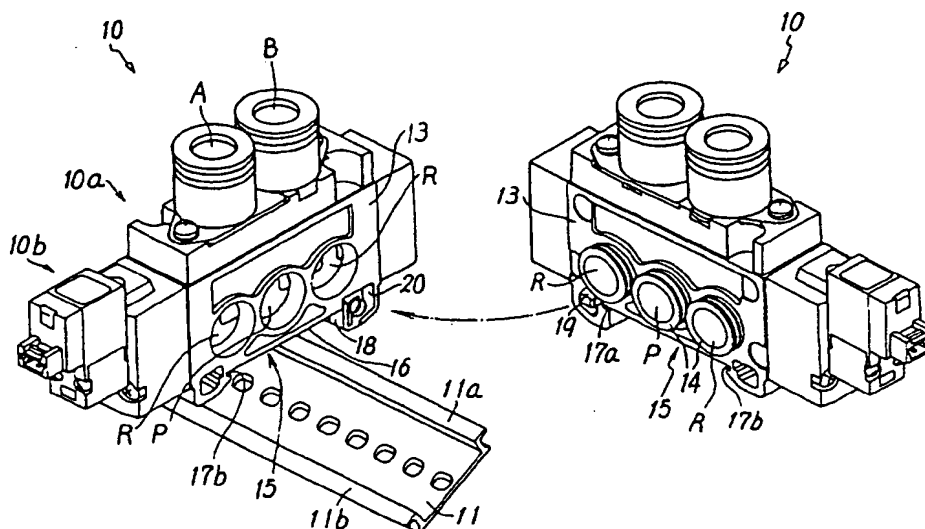
(71) Applicant SMC CORPORATION
Minato-ku Tokyo 105 (JP)

(54) Rail-mounted fluid-pressure indicating apparatus

(57) A fluid-pressure indicating apparatus 10 includes a mounting mechanism which can be simply removed from a rail 11 when the apparatus is used alone but which cannot be removed from the rail when the apparatus is coupled to adjacent apparatuses. The apparatus 10 includes recessed portions 17a and 17b formed in opposite walls of a rail mounting groove 16. An elastic

piece 18, which defines the depth of one of the recessed portions 17a is provided to the side of the recessed portion 17a in such a way as to be elastically movable. A stopper 19 is also provided to the side of the first recessed portion 17a which engages the elastic piece 18 of an adjacent fluid-pressure indicating apparatus so as to control its movement when the apparatus is coupled to the adjacent fluid-pressure indicating apparatus.

FIG.1





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 30 0038

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	EP 0 703 391 A (SMC CORP) 27 March 1996 (1996-03-27) * claim 1; figures *	1	G01L19/00
A	US 3 824 553 A (GARDNER M ET AL) 16 July 1974 (1974-07-16) * abstract; figure 1 *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			G01L F15B F16K
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 14 October 1999	Examiner Nöbrega, R
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03 92 (P4C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 99 30 0038

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on the European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

14-10-1999

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0703391 A	27-03-1996	JP 8093941 A	12-04-1996
		CN 1123374 A	29-05-1996
		US 5529088 A	25-06-1996
US 3824553 A	16-07-1974	AR 199373 A	23-08-1974
		AU 6973674 A	04-12-1975
		BE 816618 A	20-12-1974
		BR 7405065 A	24-02-1976
		CA 1024623 A	17-01-1978
		CH 563672 A	30-06-1975
		DE 2428756 A	23-01-1975
		ES 427465 A	16-07-1976
		FR 2234674 A	17-01-1975
		IT 1014660 B	30-04-1977
		JP 50048490 A	30-04-1975
		NL 7407766 A	24-12-1974
		SE 7408054 A	23-12-1974

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

THIS PAGE BLANK (USPTO)